IN THE CLAIMS:

Please CANCEL claims 1, 8, 11, 18, 25 and 26 without prejudice to or disclaimer of the recited subject matter.

Please AMEND claims 2, 12, 22, 24 and 29, and ADD new claims 30-41, as follows. Note that all the claims currently pending in this application, including those not currently being amended, have been reproduced below for the Examiner's convenience.

1. (Cancelled)

E1

2. (Currently Amended) An illumination optical system having a total reflection type light transmitting element, for illuminating a surface to be illuminated, said illumination optical system comprising:

an imaging optical system for forming an image of a light source upon a predetermined plane by use of light from the light source~~, wherein a luminous intensity distribution upon the predetermined plane has a distribution of a shape with a central void~~; and

a converting optical system for directing light from the light source image formed by said imaging optical system, to said light transmitting element, wherein said converting optical system ~~being effective to make a luminous intensity distribution upon a light entrance surface of said light transmitting element into a distribution of a shape without a central void;~~

~~wherein a diameter of flux of light upon the predetermined plane is substantially equal to a diameter of flux of light upon the light entrance surface of the light transmitting~~

~~element~~ is arranged to place the predetermined plane and a light entrance surface of said light transmitting element in a Fourier transform relation.

E1 cont'd

3. (Previously Amended) An illumination optical system according to Claim 2, wherein the light source image formed by said imaging optical system has an illuminance which is larger in a portion adjacent an optical axis of the light transmitting element than in a peripheral portion about the optical axis.

4. (Previously Amended) An illumination optical system according to Claim 2, wherein said imaging optical system includes an elliptical mirror, wherein the light source is disposed at one focal point of said elliptical mirror, and wherein the light source image formed by said imaging optical system is defined at another focal point of said elliptical mirror.

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5. (Original) An illumination optical system according to Claim 2, wherein the light source comprises a Hg lamp.

E2

6. (Previously Amended) An illumination optical system according to Claim 2, wherein said converting optical system includes first and second lens units having the same focal distance and being disposed so that a distance between principal points of the two lens units becomes equal to the focal distance, and wherein an entrance pupil of the first lens unit is disposed substantially in coincidence with the light source image formed by said imaging optical system,

while an exit pupil of the second lens unit is disposed substantially in coincidence with a light entrance surface of said light transmitting element.

Ed concl'd

7. (Previously Amended) An illumination optical system according to Claim 2, wherein said converting optical system includes an optical rod and a lens unit, wherein a light entrance surface of the optical rod is disposed substantially in coincidence with the light source image formed by said imaging optical system, and wherein one focal point position of the lens unit is disposed substantially in coincidence with a light exit surface of the optical rod, while another focal point position of the lens unit is disposed substantially in coincidence with a light entrance surface of said light transmitting element.

8. (Cancelled)

9. (Previously Cancelled)

10. (Previously Cancelled)

11. (Cancelled)

E3

12. (Currently Amended) An illumination optical ~~system,~~ system for illuminating a surface to be illuminated, with light from a light source and by use of an optical fiber bundle, said illumination optical system comprising:

an imaging optical system for forming an image of a light source on a predetermined plane, by use of light from the light source~~, wherein a luminous intensity distribution upon the predetermined plane has a distribution of a shape with a central void~~; and

a converting optical system for directing light from the light source image formed by said imaging optical system, to said optical fiber bundle, wherein said converting optical system ~~being effective to make a luminous intensity distribution upon a light entrance surface of said optical fiber bundle into a distribution of a shape without a central void;~~

~~wherein a diameter of flux of light upon the predetermined plane is substantially equal to a diameter of flux of light upon the light entrance surface of said optical fiber bundle~~ is arranged to place the predetermined plane and a light entrance surface of said optical fiber bundle in a Fourier transform relation.

13. (Previously Amended) An illumination optical system according to Claim 12, wherein the light source image formed by said imaging optical system has an illuminance which is larger in a portion adjacent an optical axis of the light transmitting element than in a peripheral portion about the optical axis.

E3 cont.

14. (Previously Amended) An illumination optical system according to Claim 12, wherein said imaging optical system includes an elliptical mirror, wherein the light source is disposed at one focal point of said elliptical mirror, and wherein the light source image formed by said imaging optical system is defined at another focal point of said elliptical mirror.

15. (Previously Amended) An illumination optical system according to Claim 12, wherein the light source comprises a Hg lamp.

16. (Previously Amended) An illumination optical system according to Claim 12, wherein said converting optical system includes first and second lens units having the same focal distance and being disposed so that a distance between principal points of the two lens units becomes equal to the focal distance, and wherein an entrance pupil of the first lens unit is disposed substantially in coincidence with the light source image formed by said imaging optical system, while an exit pupil of the second lens unit is disposed substantially in coincidence with a light entrance surface of said optical fiber bundle.

17. (Previously Amended) An illumination optical system according to Claim 12, wherein said converting optical system includes an optical rod and a lens unit, wherein a light entrance surface of the optical rod is disposed substantially in coincidence with the light source image formed by said imaging optical system, and wherein one focal point position of the lens unit is disposed substantially in coincidence with a light exit surface of the optical rod, while

E3 concl.0

another focal point position of the lens unit is disposed substantially in coincidence with a light entrance surface of said optical fiber bundle.

18. (Cancelled)

E4

19. (Previously Amended) An illumination optical system according to Claim 12, wherein said optical fiber bundle has a light entrance of one of square shape and rectangular shape, and a light exit face of arcuate shape.

20. (Previously Amended) An illumination optical system according to Claim 12, wherein said optical fiber bundle comprises a total reflection type fiber bundle.

21. (Previously Amended) An illumination optical system according to Claim 12, wherein said optical fiber bundle comprises a distributed refractivity type optical fiber bundle.

22. (Currently Amended) An illumination optical system having a total reflection type light transmitting element, for illuminating a surface to be illuminated, said illumination optical system comprising:

a plurality of light ~~source~~ sources for illuminating a predetermined plane~~, wherein a luminous intensity distribution upon the predetermined plane has a distribution of a shape with a central void~~; and

a converting optical system, disposed between the predetermined plane and said light transmitting element, for directing light from ~~the light source~~ said plurality of light sources to said light transmitting element, wherein said converting optical system ~~being effective to make a luminous intensity distribution upon a light entrance surface of said light transmitting element into a distribution of a shape without a central void~~,

~~wherein a diameter of flux of light upon the predetermined plane is substantially equal to a diameter of flux of light upon the entrance surface of said light transmitting element~~ is arranged to place the predetermined plane and a light entrance surface of said light transmitting element in a Fourier transform relation.

23. (Original) An illumination optical system according to Claim 22, wherein said light transmitting element comprises an optical rod.

24. (Currently Amended) An illumination optical system according to Claim 22, wherein ~~the light source comprises~~ said plurality of light sources comprise a plurality of laser light sources.

25. (Cancelled)

26. (Cancelled)

27. (Previously Cancelled)

28. (Previously Cancelled)

29. (Currently Amended) An illumination optical ~~system,~~ system for illuminating a surface to be illuminated, by use of an optical fiber bundle, said illumination optical system comprising:

E5

a plurality of light ~~source~~ sources for illuminating a predetermined plane~~, wherein a luminous intensity distribution upon the predetermined plane has a distribution of a shape with a central void~~; and

a converting optical system disposed between the predetermined plane and said optical fiber bundle, for directing light from ~~the light source~~ said plurality of light sources to said optical fiber bundle, wherein said converting optical system ~~being effective to make a luminous intensity distribution upon a light entrance surface of said optical fiber bundle, into a distribution without a central void,~~

~~wherein a diameter of flux of light upon the predetermined plane is substantially equal to a diameter of flux of light upon the light entrance surface of said optical fiber bundle~~ is arranged to place the predetermined plane and a light entrance surface of said optical fiber bundle in a Fourier transform relation.

30. (New) An illumination optical system according to Claim 2, wherein a luminous intensity distribution upon the predetermined plane has a distribution of a shape with a central void, and wherein said converting optical system is effective to make a luminous intensity distribution upon a light entrance surface of said light transmitting element into a distribution of a shape without a central void.

31. (New) An illumination optical system according to Claim 12, wherein a luminous intensity distribution upon the predetermined plane has a distribution of a shape with a central void, and wherein said converting optical system is effective to make a luminous intensity distribution upon a light entrance surface of said optical fiber bundle into a distribution of a shape without a central void.

32. (New) An illumination optical system according to Claim 22, wherein a luminous intensity distribution upon the predetermined plane has a distribution of a shape with a central void, and wherein said converting optical system is effective to make a luminous intensity distribution upon a light entrance surface of said light transmitting element into a distribution of a shape without a central void.

33. (New) An illumination optical system according to Claim 29, wherein a luminous intensity distribution upon the predetermined plane has a distribution of a shape with a central void, and wherein said converting optical system is effective to make a luminous intensity

distribution upon a light entrance surface of said optical fiber bundle into a distribution of a shape without a central void.

Eb cont.

34. (New) An exposure apparatus comprising:

an illumination optical system having a total reflection type light transmitting element, for illuminating a mask, wherein said illumination optical system includes (i) an imaging optical system for forming an image of a light source upon a predetermined plane by use of light from the light source, and (ii) a converting optical system for directing light from the light source image formed by said imaging optical system, to said light transmitting element, said converting optical system being arranged to place the predetermined plane and a light entrance surface of said light transmitting element in a Fourier transform relation; and

a projection optical system for projecting a pattern of the mask onto a wafer.

35. (New) A device manufacturing method, comprising steps of:

applying a resist to a wafer;

transferring, by exposure, a pattern of a mask onto the wafer by use of an exposure apparatus as recited in Claim 34; and

developing the wafer having the pattern transferred thereto.

36. (New) An exposure apparatus comprising:

an illumination optical system for illuminating a mask with light from a light source and by use of an optical fiber bundle, wherein said illumination optical system includes (i) an imaging optical system for forming an image of a light source upon a predetermined plane by use of light from the light source, and (ii) a converting optical system for directing light from the light source image formed by said imaging optical system, to said optical fiber bundle, said converting optical system being arranged to place the predetermined plane and a light entrance surface of said optical fiber bundle in a Fourier transform relation; and

a projection optical system for projecting a pattern of the mask onto a wafer.

37. (New) A device manufacturing method, comprising the steps of:

applying a resist to a wafer;

transferring, by exposure, a pattern of a mask onto the wafer by use of an exposure apparatus as recited in Claim 36; and

developing the wafer having the pattern transferred thereto.

38. (New). An exposure apparatus comprising:

an illumination optical system having a total reflection type light transmitting element, for illuminating a mask, wherein said illumination optical system includes (i) a plurality of light sources for illuminating a predetermined plane, and (ii) a converting optical system disposed between the predetermined plane and said light transmitting element, for directing light

from said plurality of light sources, to said light transmitting element, said converting optical system being arranged to place the predetermined plane and a light entrance surface of said light transmitting element in a Fourier transform relation; and

a projection optical system for projecting a pattern of the mask onto a wafer.

39. (New) A device manufacturing method, comprising the steps of:

applying a resist to a wafer;

transferring, by exposure, a pattern of a mask onto the wafer by use of an exposure apparatus as recited in Claim 38; and

developing the wafer having the pattern transferred thereto.

40. (New) An exposure apparatus comprising:

an illumination optical system for illuminating a mask by use of an optical fiber bundle, wherein said illumination optical system includes (i) a plurality of light sources for illuminating a predetermined plane, and (ii) a converting optical system disposed between the predetermined plane and said optical fiber bundle, for directing light from said plurality of light sources, to said optical fiber bundle, said converting optical system being arranged to place the predetermined plane and a light entrance surface of said optical fiber bundle in a Fourier transform relation; and

a projection optical system for projecting a pattern of the mask onto a wafer.

41. (New) A device manufacturing method, comprising the steps of:

applying a resist to a wafer;

transferring, by exposure, a pattern of a mask onto the wafer by use of an exposure apparatus as recited in Claim 40; and

developing the wafer having the pattern transferred thereto.